were heterogeneous with abnormal paradoxical responses observed in a quarter of the CSFP pts.

Conclusions: Pts with the CSFP typically present with an acute coronary syndrome prompting CCU admission. Their resting angiographic and coronary hemodynamic findings suggest that they have an underlying increased microvascular tone. The mechanism by which this increased microvascular resistance acutely deteriorates is unclear.

8:45

876-2 Endothelin$_A$ Receptor Antagonist BQ-123 Provokes Coronary Vasodilation and Blood Flow Increase in Humans

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Background: Endothelin-1 (ET-1) is an endothelium-derived vasoconstrictor peptide, possibly involved in the pathophysiology of cardiovascular disease. We examined the contribution of endogenously generated ET-1 to the maintenance of coronary (COR) vascular tone in humans by administration of a selective ETA receptor antagonist, BQ-123.

Methods: We studied 14 subjects, 7 with normal COR arteries and 7 with COR artery disease. BQ-123, in 0.9% saline, was infused in the left COR artery at a rate of 1 ml/min, 100 nmol/min for 60 min. A Doppler flow guidewire was inserted in the proximal left anterior descending (LAD) artery for measurement of the blood flow velocity. At the 60th min 200 μg of nitroglycerin (NTG) were given ic. COR angiography injections were performed at baseline (BL), immediately at the end of the BQ-123 infusion and 2 min after NTG. The diameter of proximal and distal LAD artery segments was measured by computerized quantitative angiography.

Results: (mean value ± standard error)

	Distal LAD (mm)	Proximal LAD (mm)	CBF (ml/min)	CVR (mmHg/ml/min)
BL	1.50 ± 0.08	2.90 ± 0.12	58 ± 7	2.57 ± 0.49
BQ-123	1.67 ± 0.07*	3.06 ± 0.13*	72 ± 8*	1.84 ± 0.29
NTG	1.85 ± 0.09*	3.32 ± 0.16*	43 ± 7*	3.81 ± 1.01

* p < 0.05 vs baseline. CBF: coronary blood flow; CVR: coronary vascular resistance. Heart rate and blood pressure did not change after BQ-123.

Conclusion: These findings indicate that endogenous production of ET-1 contributes to the maintenance of COR artery tone and decreases CBF in normal subjects and in COR artery disease patients. ET_A receptor antagonism reverses these effects and may have therapeutic potentials.

9:00

876-3 Sex Hormone and Atherosclerotic Risk Factor Profiles Are Not Determinants of Coronary Microvascular Reserve in Women With Chest Pain: Pilot Phase Results From WISE

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Background: Women with chest pain in the absence of coronary atherosclerosis (CAD) may have abnormal microvascular function with low coronary flow reserve (CFR). We assessed whether sex hormones and risk factors influence CFR in this population.

Methods: Women [n = 62] in the NIH Women's Ischemia Syndrome Evaluation (WISE) with chest pain in the absence of CAD underwent assessment of coronary flow velocity response to intracoronary adenosine (18 mcg) to measure CFR. CFR was correlated with sex hormones and risk factors. These factors were also compared between those with abnormal (CFR <2.2, n = 28) and normal microvascular reserve (CFR ≥2.2, n = 34).

Results: Age correlated negatively with CFR (Spearman correlation −0.30, P = 0.02). Traditional risk factors, menopause, and levels of progesterone, estrone, estradiol and lipids were not determinants of CFR. Women with abnormal microvascular reserve were older (57 v. 51 y, P = 02), but had similar hormone and risk profiles compared to those with normal microvascular reserve.

Conclusion: Age is the only significant determinant of CFR in women with chest pain in the absence of CAD. Microvascular reserve abnormalities were not found to be related to menopausal status, lipids, and sex hormones.

9:15

876-4 Effects of L-Arginine on Basal and Flow-mediated Nitric Oxide Production in Atheromatous Coronary Arteries

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Background: Previous studies in humans have shown that pacing-induced epicardial coronary artery dilation is nitric oxide dependent. The effects on this dilation of administration of L-arginine (the substrate for nitric oxide synthesis) is unknown.

Methods: In 5 patients (4 male, 1 female; mean age 61 ± 9 yrs) with coronary artery disease (CAD) and stable angina, atrial pacing (AP) 140 beats/min, was performed during the intracoronary infusion of normal saline (NS) and during infusion of 150 μmol/min L-arginine (LA). Coronary angiograms were recorded during the infusions, AP, and after intracoronary 250 mcg nitroglycerin (GTN). The diameter of 11 proximal and 12 distal segments was measured by quantitative angiography at baseline and after NS, AP + NS, AP + LA and GTN administration.

Results: The mean (± SEM) diameters and % change from baseline were:

	Proximal segments	Distal segments
NS	3.10 ± 0.14 (0.7 ± 0.3%)	1.51 ± 0.08 (0.6 ± 0.5%)
NS + AP	3.21 ± 0.14 (4.2 ± 0.9%)*	1.63 ± 0.09 (8.9 ± 1.8%)*
LA + AP	3.28 ± 0.16 (6.1 ± 1.6%)*	1.70 ± 0.09 (12.9 ± 3.1%)*°
GTN	3.40 ± 0.16 (10.5 ± 2.1%)*	1.77 ± 0.10 (18.7 ± 2.6%)*

* = p < 0.001 vs NS, ° = p < 0.05 vs NS + AP

Conclusions: The epicardial diseased coronary arteries dilate in response to atrial pacing. The addition of L-arginine augments nitric oxide dependent dilation induced by atrial pacing and therefore this may be beneficial in patients with atherosclerosis.

9:30

876-5 Close Relation Between Endothelium-dependent Flow-mediated Dilation in Coronary and Brachial Artery in Human

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Although the previous study showed that endothelial function of coronary artery (CA) assessed by acetylcholine (receptor mediated stimulus) correlated with brachial artery (BA) vasomotion during reactive hyperemia (RH, non-receptor mediated stimulus), its correlation was poor. We hypothesized that more close relation may be obtained between endothelial function of CA and BA if we use the same stimulus; increase in flow (FMD, flow-mediated dilation). In 15 patients (5 with significant coronary artery diameter stenosis, ≥70%, and 10 without), we infused 30 μg of adenosine triphosphate (ATP) through 3 F infusion catheter placed into the distal segment of the CA in order to increase flow. The percent diameter change of proximal site of the CA was analyzed by quantitative angiography for measuring FMD. FMD in BA during RH was determined using high resolution ultrasound on the day before the catheterization. The increase of CA flow by ATP infusion and that of BA during RH were similar (CA vs BA flow, 3.88 ± 1.20 vs 3.62 ± 0.95 times from baseline, mean ± SD). There was a strong correlation between FMDs in CA and BA (r = 0.78, p < 0.001).

In Conclusion: The non-invasive assessment of FMD in BA can be used as a surrogate for CA endothelial function.

9:45

876-6 Different Effect of Vitamin C on Impaired Endothelium Dependent Vasodilation in Patients With Coronary Artery Disease and Chronic Heart Failure

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Background: Impaired endothelium dependent vasodilation (EDV) in peripheral circulation has been reported in both coronary artery disease (CAD) and chronic heart failure (CHF). However, the underlying mechanism is not elucidated.

Methods: To evaluate the role of oxidative stress in the endothelial dysfunction, we examined the effect of antioxidant vitamin C (VC: 1000 mg I.V.) on flow induced EDV in 8 patients with CAD (EF59 ± 2%) and 10 patients with CHF (EF40 ± 3%) caused by idiopathic dilated cardiomyopathy. We measured the brachial artery diameter and flow velocity at rest, % increase

of diameter (%EDV) and flow velocity (%FV) during reactive hyperemia and that after sublingual nitroglycerin (%NTG), using ultrasonography.

Results: %EDV in both CAD and CHF was significantly attenuated as compared with 10 control subjects (C). However, %FV and %NTG was well preserved in both groups. VC improved %EDV in patients with CAD but not with CHF and had no effect on %NTG and %FV.

	%EDV	%EDV after VC	%NTG	%NTG after VC
C	8.2 ± 1.2		16.2 ± 2.7	
CHF	3.9 ± 0.7*	4.6 ± 0.8	14.1 ± 1.3	13.6 ± 1.2
CAD	3.8 ± 0.8*	8.3 ± 1.1**	11.0 ± 1.6	13.7 ± 1.3

mean ± SEM (* = p < 0.05, vs. %EDV in C ** = p < 0.05, vs. %EDV)

Conclusion: These results suggest that augmented oxidative stress leads to endothelial dysfunction in the brachial circulation in patients with CAD but not with CHF.

877 The Natural History of Aortic Valve Disease: Pre and Postoperative

Wednesday, April 1, 1998, 8:30 a.m.–10:00 a.m.
Georgia World Congress Center, Room 364W

8:30

877-1 Outcome of Aortic Valve Replacement in Patients With Aortic Stenosis and Low Transvalvular Gradient

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The outcome of AVR in pts with AS and low transvalvular gradient is not well known. Thus we reviewed 52 such pts (34 M; 18 F), mean age 71 ± 11 yrs with aortic mean gradient (MG) <30 mm Hg and EF ≤35% who underwent AVR between 1985–95.

Preoperative data include: EF 24 ± 7%, MG 23 ± 4 mm Hg, AVA 0.7 ± 0.2 cm^2 and CO 3.7 ± 1.2 l/min. Coronary artery disease (CAD) requiring CABG was present in 32 pts (65%), and 45 pts (86%) were severely symptomatic (NYHA Class III or IV).

All pts had AVR (17 mechanical, 35 tissue), mean AVR size 23 ± 2 mm. Nine pts (17%) had simultaneous annular patch.

Hospital mortality was 21% (11/52); there were 10 late deaths (mean follow up 1.5 yrs). Predictors of hospital mortality included advanced age (p = 0.048), (78 vs 70 yrs) and smaller AVR size (p = 0.03), (21 vs 23 mm). With multivariate analysis, AVR size was the only predictor of hospital mortality. One and 5-yr survival were 65% and 36% respectively. Symptomatic improvement was noted in 60% (18 of 30 pts), and EF improved in 74% (28 of 38 pts).

Conclusion: 1) Pts with AS, reduced EF and MG represent a high risk subset (hospital mortality, 21%), 2) predictors of hospital mortality include age and AVR size, 3) EF and symptomatic improvement occurs in the majority of survivors. Based on this experience we conclude that pts with AS, reduced EF and low MG, should not be denied AVR.

8:45

877-2 The Ross Procedure: Searching for the Gold Standard for Aortic Root Pathology: Results in 100 Consecutive Cases

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Background: The pulmonary autograft (PA) has demonstrated superior hemodynamics at rest and exercise, which together with freedom from thromboembolism and chronic anticoagulation make the PA an attractive alternative to mechanical valve replacement, especially in active young patients with isolated aortic root pathology. Questions remain regarding the safety, long-term stability, and durability of both the PA and the pulmonary homograft relative to the operations' inherent two-valve complexity.

Methods: This report summarizes the results in 100 consecutive Ross procedures, 97 with root replacement and 3 with subcoronary. All patients received pre and postoperative TEE and all were followed by transthoracic echo at yearly intervals. Patient clinical follow-up is 100% with no cases excluded (n = 100) with mean age 43 years (range 8 to 63 years)

Results: There were no operative deaths. 1 patient died of unexplained bleeding following hospital discharge, with no other late deaths. 6 patients required reoperation, 3 for autograft failure (2 partial dehiscence, 1 SBE*), 2 for progressive pulmonary homograft stenosis, and 1 patient was reoperated for left coronary stenosis felt to be technical. 1 patient had >1+ AI on f/u echo*. All patients are NYHA Class I on follow-up. Intraoperative TEE immediately after the procedure demonstrated physiologic gradients (<5 mm) in all patients with no progression on follow-up to six years, mean f/u 901 days). A subgroup of athletes (n = 15) in this series were exercised to exhaustion and demonstrated no significant difference in aortic gradient, or exercise capacity (VO2 max) when compared to a matched group of normal athletes similarly exercised.

Conclusion: This series of 100 consecutive Ross procedures demonstrates no operative mortality, low post-operative morbidity and complications including reoperation, all of which justifies the use use of the Ross procedure in young and middle-aged patients with active lifestyles.

*Subcoronary implantation technique.

9:00

877-3 The Fate of Aortic Homografts: Frequency and Significance of Echocardiographically Detectable Complications in the Long-term Follow-up of 50 Adults

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Aortic homograft (HG) valves have significantly improved mortality in patients (pts) with aortic valve endocarditis. However, long-term follow-up data are scarce. We reviewed the echocardiographic data of 50 pts (age: 47 ± 15 years) with 52 aortic HG who were seen 27 ± 30 months after aortic HG implantation. At follow-up, mean pressure gradient of the aortic valve was 14 ± 10 mmHg (range: 1–42). Overall, echocardiographically detectable complications occurred in 32 pts (62%) as shown in the table and include anastomotic pseudoaneurysms (PSA), ventricular septal defects (VSD), perforations of the anterior mitral valve leaflet, degenerative aortic regurgitation (AR) or stenosis (AS) and mitral regurgitation (MR). (LVOT = left ventricular outflow tract.)

Complications	Pt number (%)	Cause for reoperation Pt number (%)
Anastomotic PSA	20 (38%)	5 (10%)
- PSA causing tamponade		2 (4%)
Moderate or severe AR	15 (29%)	4 (8%)
Moderate AS	3 (6%)	0 (0%)
VSD	6 (12%)	2 (4%)
Communication LVOT/atria	4 (8%)	2 (4%)
Perforations ± significant MR	8 (15%)	2 (4%)

Reoperations were necessary 13 times: early (<3 months) in 5 pts or late (31 ± 25 months postoperatively) in 8 pts. Recurrent endocarditis occurred in 7 pts (13%). Hospital mortality was 8% (4 pts); 1 patient (2%) had a late death at reoperation (ischemic cerebrovascular accident).

Conclusions: After aortic HG despite the low early and late mortality, 62% of these pts have echocardiographically detectable complications including PSA, VSD, significant AR or MR, and perforations of the mitral valve. Reoperations are not uncommon due to PSA, VSD, degenerative changes with AR and/or MR due to leaflet perforation. Careful echocardiographic follow-up is mandatory after aortic HG operations.

9:15

877-4 Calcium Content in Human Aortic Valves Increases Exponentially After Age 60

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Background: Valvular calcification is now the dominant cause of aortic valve